York University   EECS 6117   January 26, 2023

Homework Assignment #2
Due: February 2, 2023 at 5:00 p.m.

1. Consider an anonymous model (no process ids; all processes run identical code) where processes are arranged in a ring. Each process receives an input bit (0 or 1). The goal is to have every process output the xor of all the input bits.

   (a) Suppose processes do not know the exact size of the ring, but they know that it is either n or $n + 1$. Show that there is no deterministic algorithm to solve the problem, even if the system is synchronous.

   (b) Now suppose processes know that the size of the ring is exactly n. Give a deterministic algorithm to compute the xor in an asynchronous system. How many messages does your algorithm use in the worst case? (The fewer, the better.)

2. Give a simple deterministic algorithm to solve the xor problem in an asynchronous ring if all processes have unique ids, but do not know the size of the ring. How many messages does your algorithm use as a function of the ring size?

   Hint: you can use any algorithm described in class as a subroutine.